The Influence of Nontidal oceanic Current and Density Changes on the Earth's Rotation and Polar Motion

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Atmospheric wind and pressures changes are the dominant mechanism causing the Earth's rotation rate to change on time scales of a few days to a few years, and are a major sours of polar motion excitation. However, upon removing the modeled effects of the atmosphere from Earth rotation and polar motion measurements, non-negligible signals remain. The effect on the Earth's rotation and polar motion of nontidal oceanic current and density fluctuations is estimated here from the products of an oceanic general circulation model in order to ascertain the degree to which they contribute to the observed residual Earth rotation and polar motion signals.

In a preliminary study of the influence of nontidal ocean processes on the Earth's rotation and polar motion, a version of the Miami isopycnal-coordinate global ocean general circulation model (OGCM) adapted by D. Hu at the Joint Institute for Studies of the Atmosphere and Ocean was run at JPL using forcing by observed winds determined from the National Centers for Environmental Prediction (NCEP; formerly the National Meteorological Center) operational analysis. This OGCM has a free surface, 11 vertical layers plus a mixed layer, realistic bottom topography, and a 2 degree longitude by 1 degree latitude grid spanning 80 S to 80 N latitude. The model was run in spinup mode for 10 years with climatological air-sea fluxes followed by a simulation spanning 1992-1994 with daily wind and heat flux from the NCEP operational analysis and sea surface salinity restoring to Levitus climatology. The axial and equatorial components of the angular momentum due to oceanic current and density fluctuations were computed and saved at 3-day intervals. Comparisons between these ocean angular momentum estimates and Earth rotation and polar motion measurements (from which atmospheric effects have been removed) will be shown.